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Associations of Academic Stress and Sociodemographic Factors with Body Composition Among Universittabley Students in Western Saudi Arabia

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Abstract **Background:** The relationship between academic stress and body composition among university students remains unclear, particularly within the Saudi context. This study investigated the associations of academic stress-measured using the validated Perceived Academic Stress (PAS) scale-and sociodemographic characteristics with body composition indicators, namely Body Mass Index (BMI) and Tri-Ponderal Mass Index (TMI), among students in the Western region of Saudi Arabia. **Methods:** A cross-sectional online survey was conducted among 651 university students aged 18-26 years during the 2024-2025 academic year. Participants self-reported sociodemographic data, anthropometric measures (height and weight) and responses to the 18-item PAS scale. Multiple linear regression analyses with backward elimination were performed to assess the associations of academic stress and sociodemographic factors with BMI and TMI. **Results:** Academic stress, whether assessed by the total PAS score or its subscales, showed no significant association with BMI ($p = 0.653$) or TMI ($p = 0.674$). In contrast, gender and age were significant predictors across both indices, while part-time employment was significantly associated with higher TMI. However, the explanatory power of the models was low ($R^2 = 6.2\%$ for BMI; $R^2 = 2.5\%$ for TMI), indicating that these factors accounted for minimal variance in body composition. **Conclusion:** Sociodemographic characteristics-particularly gender, age and employment status-were modestly associated with body composition, whereas academic stress was not. Given the limited predictive strength of these variables, future studies should employ longitudinal designs and objective anthropometric assessments while incorporating behavioral mediators such as diet, physical activity and sleep to better explain adiposity in this population.

Key Words Academic Stress, Sociodemographic Factors, Body Composition, Body Mass Index (BMI), Tri-Ponderal Mass Index (TMI), University Students, Saudi Arabia

INTRODUCTION

Obesity remains a major global public health challenge, with its prevalence rising sharply over the past few decades, particularly among young adults [1,2]. Between 1975 and 2016, the prevalence of overweight and obesity among individuals aged 5-19 years increased from less than 1% to approximately 6% among girls and 8% among boys worldwide [3]. This alarming trend is especially evident in the Middle East, where rates of overweight and obesity have escalated rapidly. In Saudi Arabia, approximately one-third of children and adolescents were classified as overweight or obese by 2016 and the national adult obesity prevalence (35%) now exceeds the global average (13%) [4]. University students represent a particularly vulnerable group, as this life stage often involves lifestyle changes such as increased consumption of fast food, irregular meal patterns, academic stress and reduced physical activity-all of which contribute to weight gain [5].

Body Mass Index (BMI) is the most widely used indicator for assessing overweight and obesity; however, it

has notable limitations. BMI does not differentiate between fat mass and lean mass, leading to potential misclassification, particularly in young and active populations [6,7]. The Tri-Ponderal Mass Index (TMI), calculated as weight divided by height cubed, has emerged as a more age-independent and stable measure of adiposity in adolescents and young adults [7]. Using both BMI and TMI in tandem may therefore provide a more accurate assessment of body composition in university student populations.

Sociodemographic factors, including gender, marital status, income and employment, have been shown to influence obesity risk [8]. In Saudi Arabia, female students are often found to have higher rates of overweight and obesity than males, a pattern attributed to lower physical activity levels and sociocultural constraints on mobility [4]. Marital status, household income and living arrangements may also affect dietary behaviors and lifestyle choices. However, few studies have comprehensively examined how these sociodemographic determinants relate to body composition in the Western region of Saudi Arabia-a culturally and economically distinct area of the country.

In addition to sociodemographic influences, academic stress has been identified as a pervasive factor affecting students' health and behaviors [9,10]. Elevated academic stress levels have been linked to emotional eating, reduced physical activity and weight gain in some settings [11]. The Perceived Academic Stress (PAS) scale provides a validated measure for assessing stress related to academic workload, examinations, self-perception and time constraints among university students [12].

Despite evidence of high obesity prevalence and academic pressure among Saudi students, research exploring the intersection between academic stress and body composition remains scarce, particularly in the Western region. Moreover, existing studies often overlook the comparative value of TMI and the role of behavioral and demographic confounders.

Therefore, the present study aimed to examine the associations of academic stress and sociodemographic factors with body composition indicators (BMI and TMI) among university students in Western Saudi Arabia. It was hypothesized that higher perceived academic stress and selected sociodemographic characteristics would be associated with higher BMI and TMI. The findings may help clarify whether psychosocial and demographic factors meaningfully contribute to adiposity among young adults in this population and guide more tailored health promotion strategies.

METHODS

Study Design and Setting

This cross-sectional study was conducted over one academic year (2024-2025) across several prominent universities in the Western region of Saudi Arabia. The required minimum sample size of 385 participants was calculated based on a 95% confidence level, 5% margin of error and an estimated population proportion of 0.5. To enhance representativeness and account for possible non-responses, the final sample included 651 students aged 18-26 years.

Participants were recruited using an online survey link disseminated through official university communication channels, including institutional emails and student groups. Although recruitment was described as random, the sampling was effectively convenience-based due to voluntary participation. Eligible participants were full-time or part-time university students within the target age range. Ethical approval was obtained from the Institutional Review Board (IRB) of Umm Al-Qura University, Makkah, Saudi Arabia. All participants provided informed consent electronically before data collection and participation was voluntary and anonymous. Confidentiality of responses was maintained throughout the study in accordance with the Declaration of Helsinki.

Assessment of Sociodemographic Characteristics

A structured questionnaire collected detailed sociodemographic information, including age, gender, parental education level, current employment status, marital status, monthly household income and current living arrangement. These variables were selected based on previous literature linking them to differences in body composition and lifestyle among university students [4,8].

Assessment of Academic Stress

Academic stress was measured using the Perceived Academic Stress (PAS) Scale developed by Bedewy and Gabriel [12]. The instrument consists of 18 items, each rated on a five-point Likert scale ranging from 1 = Strongly agree to 5 = Strongly disagree. Items 5, 9, 13, 14 and 15 were reverse scored as recommended by the scale's authors. Higher total scores indicate higher perceived academic stress.

The PAS comprises four validated subscales:

- Academic expectations
- Workload and examinations
- Academic self-perception
- Time restraints

The total PAS score and subscale scores were used in regression analyses as independent variables. The internal consistency of the PAS scale in this study was satisfactory (Cronbach's $\alpha = 0.86$).

Assessment of Body Composition Variables

Participants self-reported their height (cm) and weight (kg) following clear instructions on accurate measurement procedures. These values were used to calculate:

- **Body Mass Index (BMI):** Weight (kg)/height $(m)^2$
- **Tri-Ponderal Mass Index (TMI):** Weight (kg)/height $(m)^3$ [7]

For descriptive purposes, BMI was categorized as follows:

- Underweight: <18.5
- Normal weight: 18.5-24.9
- Overweight: 25.0-29.9
- Obese: ≥30.0

To enhance data validity, responses with implausible anthropometric values (e.g., height <120 cm or >200 cm, weight <30 kg or >200 kg) were screened and excluded.

Data Analysis

Data were analyzed using STATA (version 17.0; StataCorp, College Station, TX, USA). Descriptive statistics were generated for all variables. Continuous variables were summarized as means and Standard Deviations (SD), while categorical variables were presented as frequencies and percentages.

The internal reliability of the PAS scale was evaluated using Cronbach's alpha. To explore associations between academic stress and body composition, multiple linear regression analyses were conducted separately for BMI and TMI. Both the total PAS score and its four subscales were examined as predictors, adjusting for all sociodemographic variables.

A backward elimination procedure was applied to retain significant predictors. Beta coefficients (β), p-values and R^2 values were reported for each final model. Statistical significance was set at $p<0.05$.

Quality Control and Limitations

Given the reliance on self-reported anthropometric data, potential measurement bias was acknowledged. Duplicate entries were prevented through survey software settings and data were screened for logical consistency. The online distribution method may have introduced selection bias, favoring students with digital access. However, the large sample size and multi-university recruitment helped improve generalizability.

RESULTS

Sociodemographic Characteristics of Participant

A total of 651 have answered the study questionnaires. The mean age of participants was 20.38 years (SD = 1.40), with a mean weight of 67.05 kg (SD = 22.33) and a mean height of 166.74 cm (SD = 9.14). Ages ranged from 18 to 25 years, weight from 32 to 256 kg and height from 129 to 192 cm. Participants had a BMI mean of 23.96 (SD = 7.01) and TMI mean of 14.37 (SD = 4.12). Participants' demographic data is shown in Table 1. The majority of participants were males (60%). Regarding their current employment status, most participants were students (91%) and a smaller proportion reported being full-time and part-time employed students (3 and 6%, respectively). Over half of the participants reported that their parents had attained a bachelor's degree (55%), followed by the high school degree (24%), less than high school (10%) and only 11% of them had postgraduate or professional degrees. Most of participants (42%) reported a household income between 10,000 and 20,000 SAR and 32% reported a household income of less than 10,000 SAR

Table 1: Participants' Sociodemographic Characteristics

Variable	N (%)
Gender	
Male	393 (60%)
Female	258 (40%)
Current employment status	
Student	588 (91%)
Student and full-time employed	23 (3%)
Student and part-time employed	40 (6%)
Parents' highest level of education	
Less than high school	63 (10%)
High school or equivalent	158 (24%)
Bachelor's degree	357 (55%)
Postgraduate or professional degree	37 (11%)
Total monthly household income (including additional income)	
Less than 10,000 SAR	206 (32%)
10,000-20,000 SAR	277 (42%)
More than 20,000 SAR	168 (26%)
Current living arrangement	
With my family	568 (87%)
With roommates/friends	26 (4%)
Alone	57 (9%)
Marital status	
Single	639 (98%)
Married	11 (1%)
Divorced	1 (1%)
BMI	
Underweight	109 (17%)
Normal weight	334 (51%)
Overweight	118 (18%)
Obese	90 (14%)

Table 2: Participants' Answers to Perceived Academic Stress questions

Statement	Agree N (%)	Neutral N (%)	Disagree N (%)	Strongly disagree N (%)	Strongly agree N (%)
1. Competition with peers over grades is intense	111 (17.05)	142 (21.81)	219 (33.64)	86 (13.21)	93 (14.29)
2. My instructors criticize my academic performance	36 (5.53)	53 (8.14)	132 (20.28)	171 (26.27)	259 (39.78)
3. Teachers have unrealistic expectations of me	46 (7.07)	77 (11.83)	178 (27.34)	152 (23.35)	198 (30.41)
4. My parents' unrealistic expectations cause me stress	97 (14.90)	153 (23.50)	142 (21.81)	104 (15.98)	155 (23.81)
5. Time allocated for study and academic work is sufficient*	85 (13.06)	158 (24.27)	184 (28.26)	139 (21.35)	85 (13.06)
6. The study curriculum (workload) is excessive	197 (30.26)	188 (28.88)	179 (27.50)	49 (7.53)	38 (5.84)
7. I think the required workload is too much	182 (27.96)	171 (26.27)	182 (27.96)	78 (11.98)	38 (5.84)
8. I won't be able to catch up if I fall behind in work	134 (20.58)	190 (29.19)	158 (24.27)	122 (18.74)	47 (7.22)
9. I have enough time to relax after work*	72 (11.06)	196 (30.11)	183 (28.11)	129 (19.82)	71 (10.91)
10. Exam questions are usually Difficult	126 (19.35)	207 (31.80)	225 (34.56)	67 (10.29)	26 (3.99)
11. Exam time is too short to complete the answers	141 (21.66)	132 (20.28)	181 (27.80)	135 (20.74)	62 (9.52)
12. Exam periods are very stressful for me	255 (39.17)	170 (26.11)	146 (22.43)	54 (8.29)	26 (3.99)
13. I am confident that I will be a successful student*	345 (53.00)	178 (27.34)	90 (13.82)	21 (3.23)	17 (2.61)
14. I am confident that I will succeed in my future career*	375 (57.60)	161 (24.73)	82 (12.60)	16 (2.46)	17 (2.61)
15. I can make academic decisions easily*	185 (28.42)	221 (33.95)	177 (27.19)	45 (6.91)	23 (3.53)
16. I am afraid of failing courses this Year	199 (30.57)	100 (15.36)	123 (18.89)	103 (15.82)	126 (19.35)
17. I believe that exam anxiety reflects a personal weakness	52 (7.99)	66 (10.14)	106 (16.28)	196 (30.11)	231 (35.48)
18. Even if I pass exams, I worry	173 (26.57)	151 (23.20)	135 (20.74)	95 (14.59)	97 (14.90)

*These items have reverse scoring (1: Strongly disagree to 5: Strongly agree)

and the rest had more than 20,000 SAR. Among participants, only 9 and 4% lived either alone or with roommates respectively, whereas the rest of them lived with their families. Almost all participants were single, with only 1% were married and another 1% were divorced. Based on BMI classifications, most of participants (51%) had normal weight, 17, 18% and 14% were classified as underweight, overweight and obese.

Prevalence of PAS Among Participants

When participants answered PAS questions, they answered differently as shown in Table 2. The mean total score on PAS was 55.79 (SD = 10.07). Subscale means were as follows: pressures to perform (Mean = 17.16, SD = 4.39), workload and exams (Mean = 9.87, SD = 3.51), academic self-perception (Mean = 18.23, SD = 3.47) and time restraints (m = 10.54, SD = 3.06).

The Association Between PAS Scales and BMI

The linear regression models examined the effect of PAS in predicting BMI and TMI separately. These models included age, gender, parental education, employment status, marital status, family income and living arrangement. In the first model predicting BMI, using PAS total score and demographic variables. PAS total was not a significant predictor ($p = 0.653$) and was excluded in backward elimination steps. In the final model, only gender (female $\beta = -1.56$, $p<0.001$) and age ($\beta = 0.26$, $p = 0.017$) were statistically significant predictors, explaining 6.2% of the variance in BMI, $F(3, 647) = 14.28$, $p<0.001$. The second model used the four PAS subscales alongside the same demographic variables to predict BMI. None of the PAS subscales were significant predictors (p-values>0.05) and only gender (female $\beta = -1.56$, $p<0.001$) and age ($\beta = 0.26$, $p = 0.017$) remained statistically significant predictors in the final model, again explaining 6.2% of the variance, $F(3, 647) = 14.28$, $p<0.001$.

The association between PAS scales and TMI

The third model assessed whether PAS total and demographic variables predicted TMI. The PAS total was not a significant predictor ($p = 0.674$). In the final model, gender (female $\beta = -1.00$, $p = 0.002$), age ($\beta = 0.28$, $p = 0.015$) and employment status ($\beta = -0.70$, $p = 0.029$; students with no or full-time employment had lower TMI than those with part-time employment) were significant predictors, accounting for 2.5% of the variance in TMI, $F(3, 647) = 5.43$, $p = 0.001$. Lastly, a regression model using the PAS subscalesW and demographic controls to predict TMI. None of the PAS subscales significantly predicted TMI (p values>0.05) and the final model retained only gender (female $\beta = -1.00$, $p = 0.002$), age ($p = 0.015$) and employment status ($\beta = -0.70$, $p = 0.029$; part-time employed students had higher TMI), again explaining 2.5% of the variance, $F(3, 647) = 5.43$, $p = 0.001$.

DISCUSSION

This study investigated the associations between academic stress and sociodemographic characteristics with body composition indicators-Body Mass Index (BMI) and Tri-Ponderal Mass Index (TMI)-among university students in the Western region of Saudi Arabia. The results demonstrated that academic stress, as measured by the Perceived Academic Stress (PAS) scale, was not significantly associated with either BMI or TMI. In contrast, certain sociodemographic factors-particularly gender, age and employment status-emerged as statistically significant predictors, although the overall explanatory power of the regression models was low ($R^2 = 6.2\%$ for BMI; $R^2 = 2.5\%$ for TMI). These findings suggest that while sociodemographic characteristics may have some association with body composition, they collectively explain only a small proportion of variance, highlighting the complex and multifactorial nature of adiposity among university students.

The observed gender and age differences align with previous research conducted in other regions of Saudi Arabia.

For instance, a study among university students in the southwestern region reported that being male and older were significantly associated with higher odds of obesity ($p = 0.019$ and $p = 0.002$, respectively) [13]. Similarly, studies in both the western and southern regions have confirmed that male students tend to have higher BMI values than female students [14,15]. These findings underscore the influence of gender-related lifestyle patterns, where male students may engage in higher caloric intake and lower dietary restraint, whereas female students often report greater concern about body image and weight control behaviors.

Consistent with earlier work across the Gulf Cooperation Council (GCC) countries, the current study found no significant link between academic stress and body composition. Research conducted in Kuwait ($p = 0.791$) [16] and Bahrain ($p = 0.85$) [17] likewise found that academic stress was not associated with BMI among university students. In another Saudi study, nearly half (47.9%) of students who reported academic stress were within the normal weight category [18]. Collectively, these findings indicate that academic stress alone may not serve as a meaningful predictor of adiposity, suggesting that the relationship between stress and body composition may be mediated through behavioral pathways such as dietary intake, physical activity or sleep quality-factors not measured in the present study.

The employment-TMI association observed here, where part-time employed students displayed higher TMI values, warrants further exploration. One possible explanation is that part-time employment may increase sedentary time or reduce opportunities for physical activity, especially when combined with academic responsibilities. Alternatively, this pattern could reflect unmeasured socioeconomic or lifestyle differences rather than a causal relationship.

The use of both BMI and TMI represents a methodological strength, as TMI provides a more age-independent and stable estimate of body composition among young adults [7]. Additionally, the relatively large sample size and use of a validated academic stress scale enhance the reliability of the findings. Nonetheless, several important limitations must be acknowledged. First, the cross-sectional design precludes inference of causality between stress, sociodemographic factors and adiposity. Second, the reliance on self-reported anthropometric data introduces potential measurement bias, as participants may underestimate their weight or overestimate their height. Third, the lack of behavioral and lifestyle data (e.g., diet, exercise and sleep) limits the ability to interpret the mechanisms underlying the observed associations. Lastly, the sample was drawn primarily from major universities in the Western region, which may restrict the generalizability of findings to other Saudi university populations.

Despite these limitations, this study contributes valuable regional evidence by showing that academic stress does not appear to influence body composition among Saudi university students, while modest associations exist for select sociodemographic variables. Importantly, the very low R^2 values emphasize that the examined predictors explain only a small portion of variation in BMI and TMI, suggesting that other unmeasured biological, psychological and environmental factors likely play stronger roles.

CONCLUSIONS

This study found that academic stress, as measured by the Perceived Academic Stress scale, was not a significant predictor of either Body Mass Index (BMI) or Tri-Ponderal Mass Index (TMI) among university students in Western Saudi Arabia. Instead, gender, age and employment status emerged as statistically significant but weak predictors of body composition. Given the minimal variance explained by these models, the practical significance of these associations is limited.

Future research should adopt longitudinal designs incorporating objective anthropometric measurements and behavioral mediators such as diet, sleep and physical activity to better understand the pathways linking stress and adiposity. University-based obesity prevention programs should thus prioritize modifiable lifestyle and environmental factors rather than focusing solely on psychological stress.

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Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this article. No financial, personal or institutional relationships were present that could be perceived as influencing the work reported in this paper.

Ethical Approval and Consent to Participate

The study protocol was reviewed and approved by the Institutional Review Board of Umm Al-Qura University, Makkah, Saudi Arabia (IRB approval number available upon request). This study has been ethically approved by the institutional ethical committee (CCBE150321).

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